

increased in accordance with the steering angular velocity based on the detected steering angle. According to such a power steering apparatus, it is possible to abruptly change the flow rate to be controlled of the hydraulic control valve from the small flow rate as small as possible or zero flow rate to high flow rate as compared with the conventional small flow rate.

IN THE CLAIMS:

Please cancel claims 1-28 without prejudice or disclaimer.

Please add the following new claims 29-68 as follows:

--29. A hydraulic control valve comprising:

a valve body, including a plurality of valve body posts;

a valve spool, fitted into said valve body so as to be changeable in relative angle,

said valve spool including a plurality of valve spool posts;


wherein only one of said valve body or said valve spool include alternate pairs of chamfers.

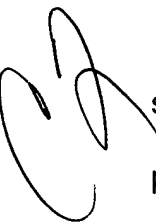
30. The hydraulic control valve according to claim 29, wherein alternating pairs of chamfers are on consecutive valve spool posts.

31. The hydraulic control valve according to claim 29, wherein alternating pairs of chamfers are on the same valve spool posts.

32. The hydraulic control valve according to claim 29, wherein alternating pairs of chamfers are on the same valve body posts.


33. The hydraulic control valve according to claim 29, wherein alternating pairs of chamfers are on consecutive valve body posts.

 34. The hydraulic control valve according to claim 29, wherein said valve body includes a plurality of first oil grooves formed between said valve body posts.

 35. The hydraulic control valve according to claim 34, wherein said valve spool includes a plurality of second oil grooves formed between said valve spool posts.

36. The hydraulic control valve according to claim 35, wherein gaps between said first and second oil grooves, which are adjacent in the peripheral direction act as throttle portions which change throttle areas in accordance with a relative angular displacement between said valve body and valve spool.

37. The hydraulic control valve according to claim 35, wherein ones of said first and second oil grooves alternately act as oil supply chambers and oil discharge chambers, and the others of said first and second oil grooves acting as oil feed chambers interposed between said oil supply chambers and oil discharge chambers.

 38. The hydraulic control valve according to claim 29, wherein chamfers adjust throttle area.

39. A power steering apparatus, comprising;
a hydraulic pump, being driven by an electric motor for supplying oil pressure to a hydraulic cylinder for steering assistance; and
a hydraulic control valve, interposed in a hydraulic pressure path between said hydraulic pump and hydraulic cylinder, for controlling oil pressure from said hydraulic pump to two cylinder chambers included in said hydraulic cylinder, wherein said hydraulic control valve is the hydraulic control valve described in claim 29.

40. A power steering apparatus, comprising;
a hydraulic pump, being driven by an electric motor for supplying oil pressure to a hydraulic cylinder for steering assistance; and
a hydraulic control valve, interposed in a hydraulic pressure path between said hydraulic pump and hydraulic cylinder, for controlling oil pressure from said hydraulic pump to two cylinder chambers included in said hydraulic cylinder, wherein said hydraulic control valve is the hydraulic control valve described in claim 30.

41. A power steering apparatus, comprising;
a hydraulic pump, being driven by an electric motor for supplying oil pressure to a hydraulic cylinder for steering assistance; and
a hydraulic control valve, interposed in a hydraulic pressure path between said hydraulic pump and hydraulic cylinder, for controlling oil pressure from said hydraulic pump to two cylinder chambers included in said hydraulic cylinder, wherein said hydraulic control valve is the hydraulic control valve described in claim 31.

42. A power steering apparatus, comprising;
a hydraulic pump, being driven by an electric motor for supplying oil pressure to a hydraulic cylinder for steering assistance; and
a hydraulic control valve, interposed in a hydraulic pressure path between said hydraulic pump and hydraulic cylinder, for controlling oil pressure from said hydraulic pump to two cylinder chambers included in said hydraulic cylinder, wherein said hydraulic control valve is the hydraulic control valve described in claim 32.

43. A power steering apparatus, comprising;
a hydraulic pump, being driven by an electric motor for supplying oil pressure to a hydraulic cylinder for steering assistance; and
a hydraulic control valve, interposed in a hydraulic pressure path between said hydraulic pump and hydraulic cylinder, for controlling oil pressure from said hydraulic pump to two cylinder chambers included in said hydraulic cylinder, wherein said hydraulic control valve is the hydraulic control valve described in claim 33.

~~44. The power steering apparatus according to claim 40, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried out, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out.~~

~~45. The power steering apparatus according to claim 44, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate~~

~~when steering is not carried out, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out.~~

46. The power steering apparatus according to claim 45, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried out, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out.

47. The power steering apparatus according to claim 46, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried out, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out.

48. The power steering apparatus according to claim 47, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried out, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out.

49. The power steering apparatus according to claim 40 wherein said electric motor drives said hydraulic pump such that oil pressure is supplied at zero flow rate or predetermined small flow rate as small flow as possible when steering is not carried out, and the oil pressure is abruptly supplied at high flow rate in accordance with the steering angular velocity as the steering is carried out.

50. The power steering apparatus according to claim 44 wherein said electric motor drives said hydraulic pump such that oil pressure is supplied at zero flow rate

~~or predetermined small flow rate as small flow as possible when steering is not carried out, and the oil pressure is abruptly supplied at high flow rate in accordance with the steering angular velocity as the steering is carried out.~~

51. The power steering apparatus according to claim 45 wherein said electric motor drives said hydraulic pump such that oil pressure is supplied at zero flow rate or predetermined small flow rate as small flow as possible when steering is not carried out, and the oil pressure is abruptly supplied at high flow rate in accordance with the steering angular velocity as the steering is carried out.

52. The power steering apparatus according to claim 46 wherein said electric motor drives said hydraulic pump such that oil pressure is supplied at zero flow rate or predetermined small flow rate as small flow as possible when steering is not carried out, and the oil pressure is abruptly supplied at high flow rate in accordance with the steering angular velocity as the steering is carried out.

53. The power steering apparatus according to claim 47 wherein said electric motor drives said hydraulic pump such that oil pressure is supplied at zero flow rate or predetermined small flow rate as small flow as possible when steering is not carried out, and the oil pressure is abruptly supplied at high flow rate in accordance with the steering angular velocity as the steering is carried out.

54. A power steering apparatus, comprising:
a hydraulic pump, being driven by an electric motor, for supplying oil pressure to a hydraulic cylinder; and

a hydraulic control valve, for controlling oil pressure from said hydraulic pump to cylinder chambers included in said hydraulic cylinder;

said hydraulic control valve comprising:

a valve body, including a plurality of valve body posts;

a valve spool, fitted into said valve body so as to be changeable in relative angle,

said valve spool including a plurality of valve spool posts;

chamfers, wherein said chamfers are the chamfers of claim 29.

55. A power steering apparatus, comprising;

a hydraulic pump, being driven by an electric motor, for supplying oil pressure to a hydraulic cylinder; and

a hydraulic control valve, for controlling oil pressure from said hydraulic pump to cylinder chambers included in said hydraulic cylinder,

said hydraulic control valve comprising:

a valve body, including a plurality of valve body posts;

a valve spool, fitted into said valve body so as to be changeable in relative angle,

said valve spool including a plurality of valve spool posts;

chamfers, wherein said chamfers are the chamfers of claim 30.

~~56.~~ A power steering apparatus, comprising;

a hydraulic pump, being driven by an electric motor, for supplying oil pressure to a hydraulic cylinder; and

a hydraulic control valve, for controlling oil pressure from said hydraulic pump to cylinder chambers included in said hydraulic cylinder,

said hydraulic control valve comprising:

a valve body, including a plurality of valve body posts;

a valve spool, fitted into said valve body so as to be changeable in relative angle,

said valve spool including a plurality of valve spool posts;

chamfers, wherein said chamfers are the chamfers of claim 31.

~~57~~ A power steering apparatus, comprising;

a hydraulic pump, being driven by an electric motor, for supplying oil pressure to a hydraulic cylinder; and

a hydraulic control valve, for controlling oil pressure from said hydraulic pump to cylinder chambers included in said hydraulic cylinder,

said hydraulic control valve comprising:

a valve body, including a plurality of valve body posts;

a valve spool, fitted into said valve body so as to be changeable in relative angle,

said valve spool including a plurality of valve spool posts;

chamfers, wherein said chamfers are the chamfers of claim 32.

~~58~~ A power steering apparatus, comprising;

a hydraulic pump, being driven by an electric motor, for supplying oil pressure to a hydraulic cylinder; and

a hydraulic control valve, for controlling oil pressure from said hydraulic pump to cylinder chambers included in said hydraulic cylinder,

said hydraulic control valve comprising:

a valve body, including a plurality of valve body posts;

a valve spool, fitted into said valve body so as to be changeable in relative angle,
said valve spool including a plurality of valve spool posts;
chamfers, wherein said chamfers are the chamfers of claim 33.

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59. ~~The power steering apparatus according to claim 49, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out.~~

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60. ~~The power steering apparatus according to claim 50, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out.~~

61. ~~The power steering apparatus according to claim 51, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out.~~

62. ~~The power steering apparatus according to claim 52, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out.~~

63. The power steering apparatus according to claim 53, wherein said hydraulic pump is driven such that a flow rate becomes low flow rate or zero flow rate when steering is not carried, and such that the flow rate becomes high in accordance with steering angular velocity when steering is carried out. --